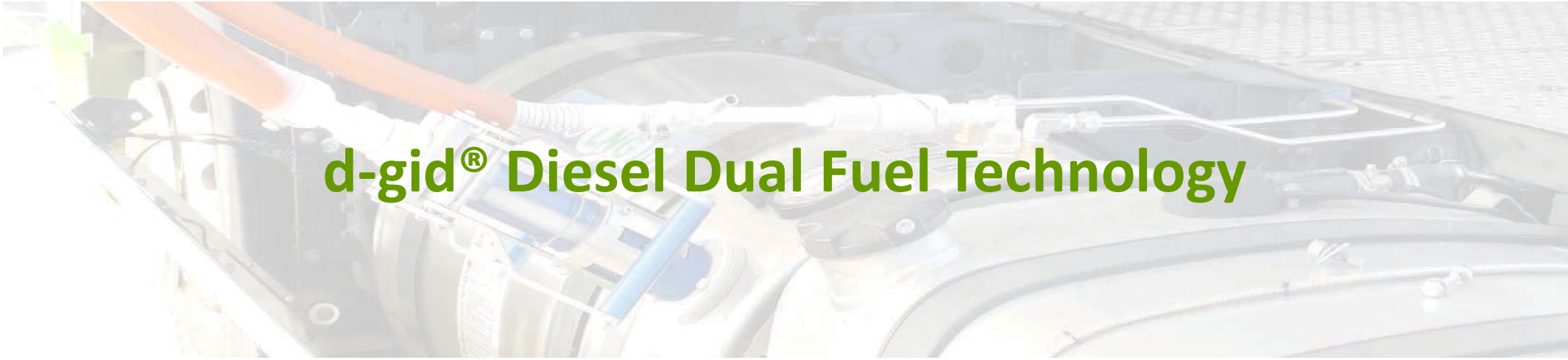
AUTOGAS
Aitalia
www.autogasitalia.it

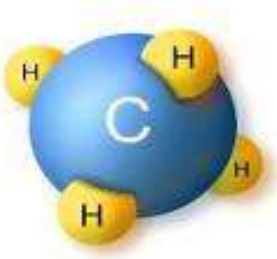


d-gid® Diesel Dual Fuel Technology

d-gid® Dual Fuel Technology

d-gid® Diesel Dual Fuel Basic Knowledge

Natural Gas



Diesel Dual Fuel (DDF)
d-gid® ECU
*(**d**iesel-**g**as **i**njection **d**ynamic)*

Diesel Engine

Diesel / Natural Gas
Average Substitution Rate

■ 50÷60% Natural Gas

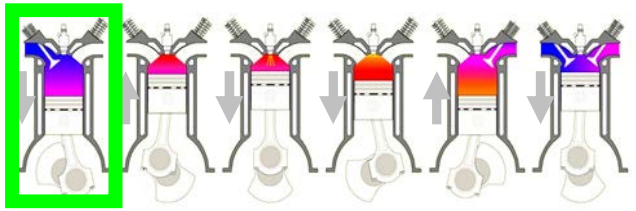
■ 50÷40% Diesel

"**Diesel Dual Fuel**" refers to an engine working with Diesel and Natural Gas (CNG or LNG) simultaneously

d-gid system allowing to fuel diesel engines with a mixture of diesel oil and natural gas (CNG compressed natural gas, LNG liquefied natural gas, Biomethane, Syngas, etc.), d-gid Control Unit determines the amount of diesel fuel injected and air/gas mixture dosage dynamically, modifying it in real time according to the feedback provided by the engine to guarantee perfect operational conditions.

Diesel Dual Fuel Cycle

INTAKE

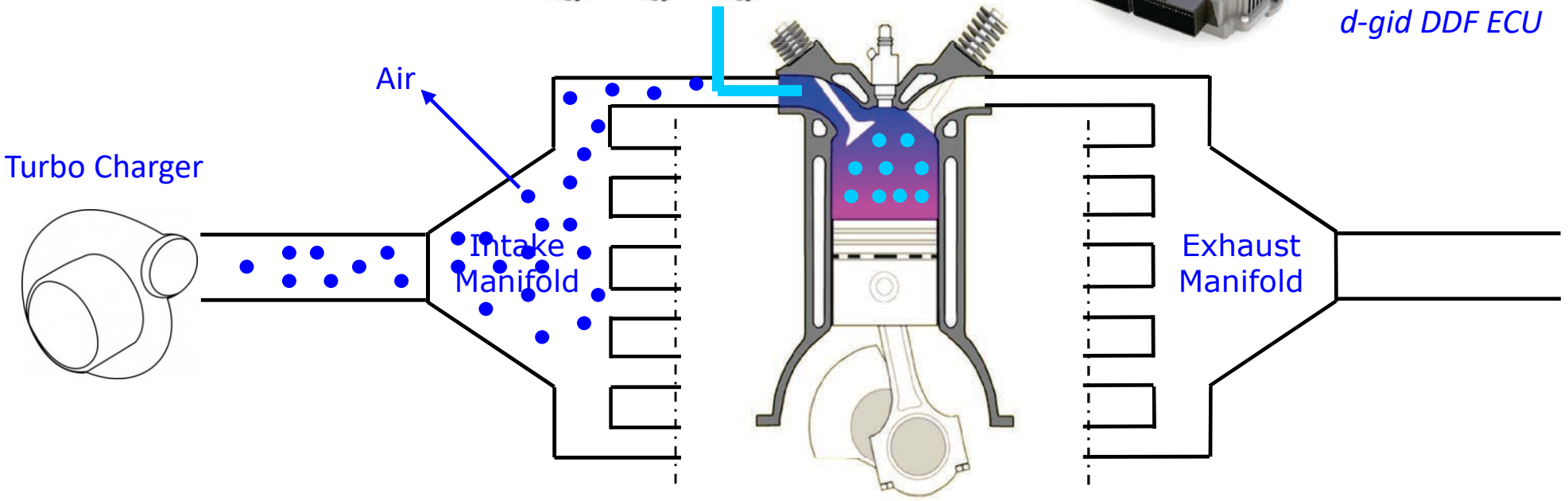


Four Stoke Diesel Cycle

Natural Gas
low pressure feeding line

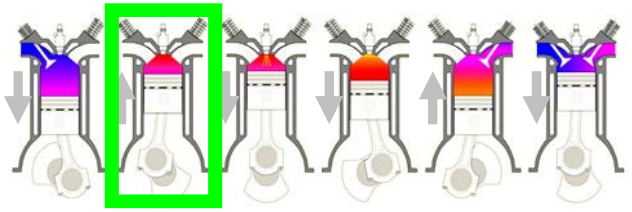
Natural Gas
Injectors

Injected Natural Gas is controlled by d-gid DDF ECU



Diesel Dual Fuel Cycle

COMPRESSION



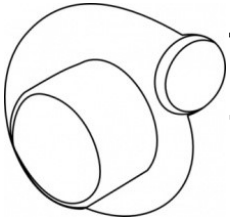
Four Stoke Diesel Cycle

Natural Gas
low pressure feeding line

Natural Gas
Injectors

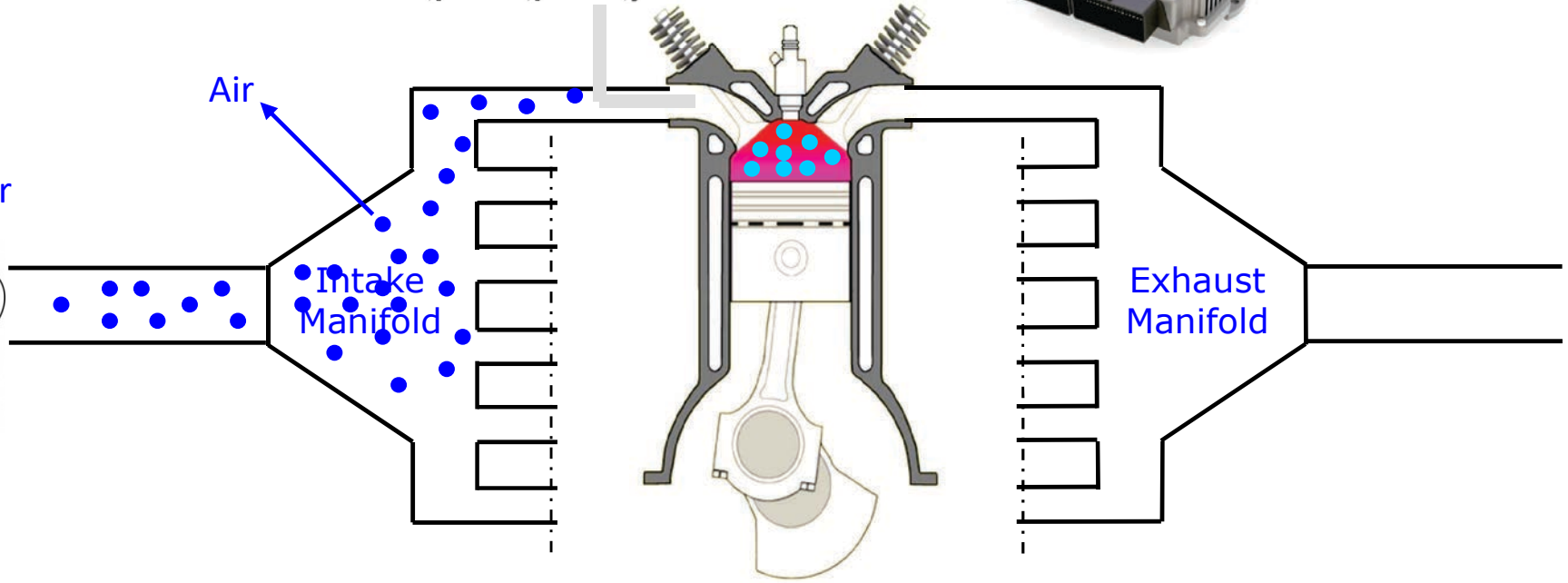
Air

Turbo Charger



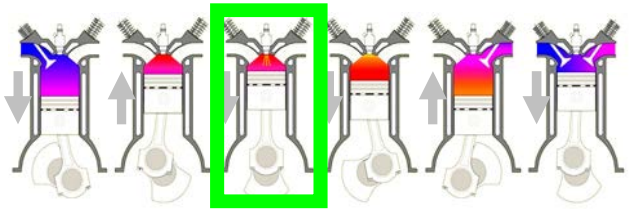
Intake Manifold

Exhaust Manifold



Diesel Dual Fuel Cycle

IGNITION



Four Stoke Diesel Cycle

Natural Gas
low pressure feeding line

Natural Gas
Injectors

Injected Diesel is override and controlled by d-gid DDF ECU

Air

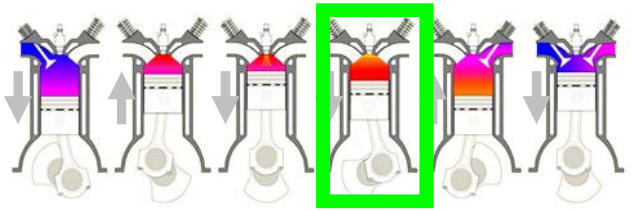
Turbo Charger

Intake Manifold

Exhaust Manifold

Diesel Dual Fuel Cycle

POWER



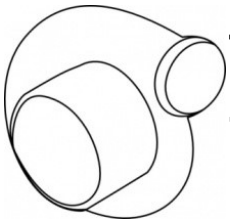
Four Stoke Diesel Cycle

Natural Gas
low pressure feeding line

Natural Gas
Injectors

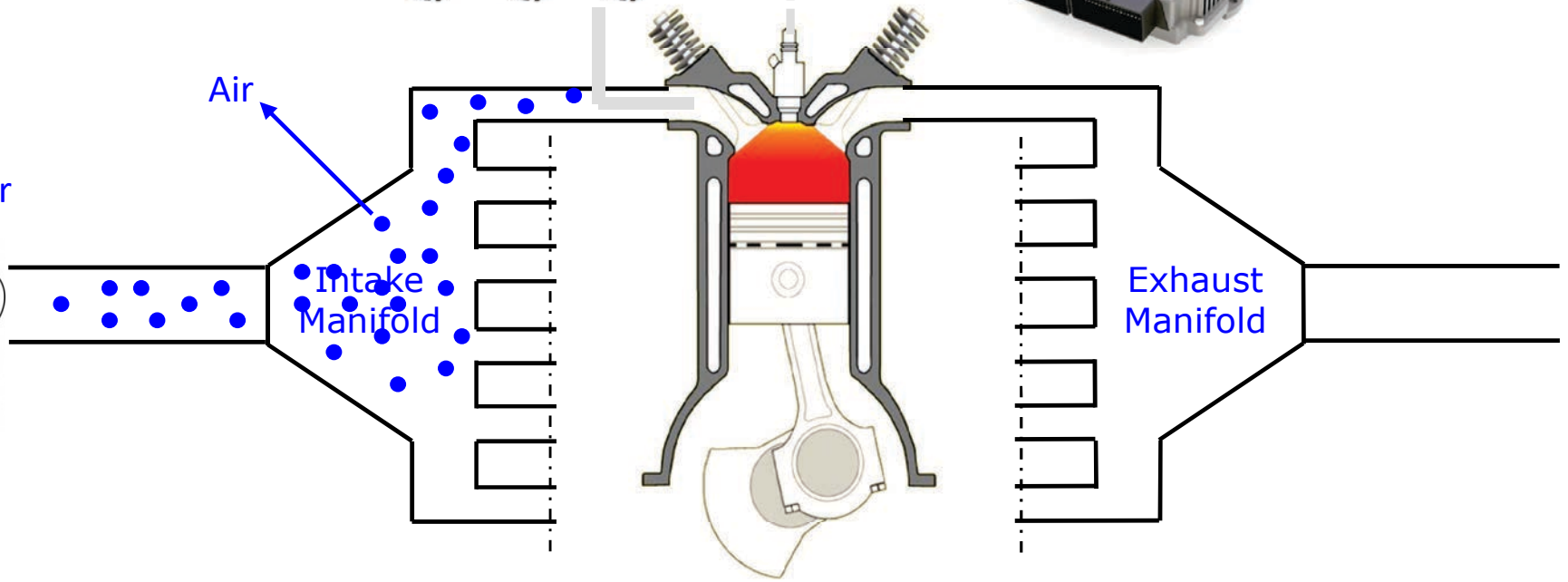
Air

Turbo Charger



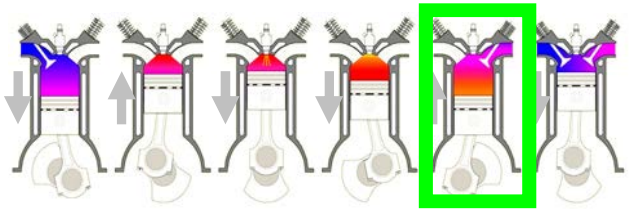
Intake
Manifold

Exhaust
Manifold



Diesel Dual Fuel Cycle

EXHAUST



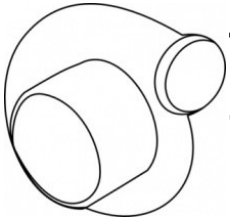
Four Stoke Diesel Cycle

Natural Gas
low pressure feeding line

Natural Gas
Injectors

Air

Turbo Charger



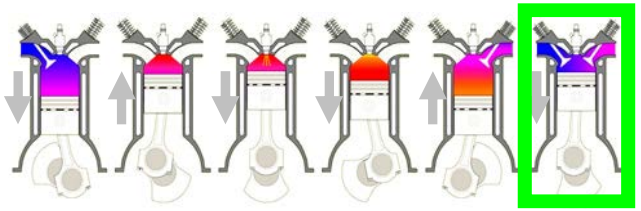
Intake Manifold

Exhaust gases cleaner then Diesel

Exhaust Manifold

Diesel Dual Fuel Cycle

OVERLAP



Four Stoke Diesel Cycle

Natural Gas
low pressure feeding line

Natural Gas
Injectors

Air

Turbo Charger

Intake Manifold

Exhaust Manifold

Exhaust gases cleaner then Diesel

d-gid® Flexible CNG & LNG Dual Fuel System

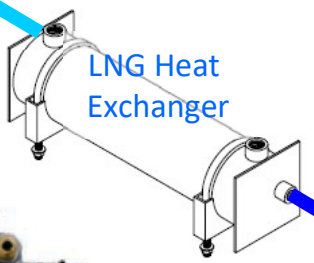
LNG / BioLNG
Liquid Natural Gas
Cryogenic Tank Storage

Cryogenic Storage
Liquid Natural Gas
-150°C ÷ -140°C 8-10 bar

CNG / BioCNG
Compressed Natural Gas
Hi-pressure Cylinders Storage

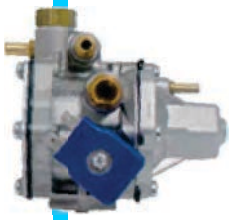
Hi Pressure Storage
Compressed Natural Gas
220 bar

d-gid® ECU can easily manage both LNG and CNG
according with desired Dual Fuel strategy



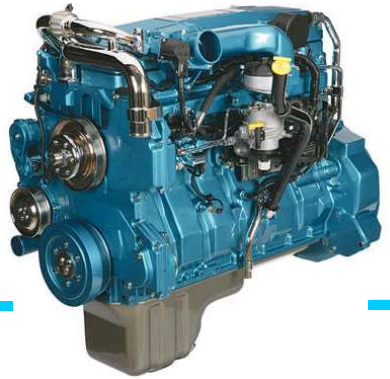
LNG Heat
Exchanger

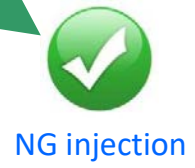
NG pressure
regulator
Input
10-16 bar
Output
3 bar



NG press.
2÷3 bar

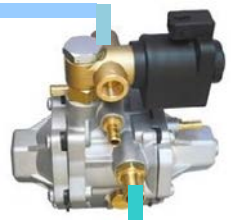
NG injection





NG injection

NG press.
2÷3 bar



NG pressure
regulator
Input
220 bar
Output
2÷3 bar

Diesel Dual Fuel Advantages

✓ Low impact on the architecture of the engine, which remain a standard Diesel cycle engine: 100% fullback Diesel at any time. No irreversible modification achieved.

✓ Possibility to switch between Diesel/Gas mixture and 100% Diesel mode simply by pressing an on/off selector.

✓ Automatic set to 100% diesel when the natural gas tank is empty or in case of trouble detection.

✓ The engine does not decrease performance and efficiency in DDF mode: torque and power outcomes remain practically unvaried.

✓ Particulate reductions.

✓ Carbon footprint/emission reduced.

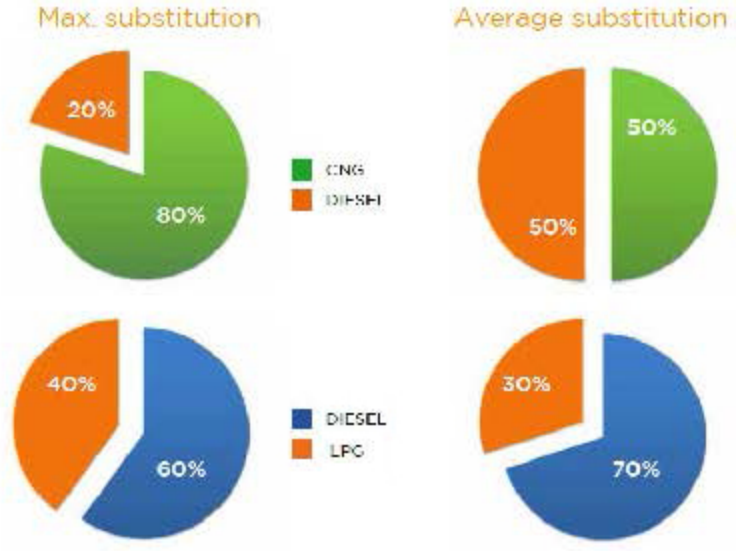
✓ Improved engine oil quality determined by high reductions of carbon emission.

✓ Engine noise reduced up to 5db thanks to natural gas smoother combustion.

✓ Significant reductions of operating costs thanks to Diesel-Gas substitution.

DIESEL vs LPG vs CNG vs LNG

Range comparison of a Diesel Truck with 400 l Diesel vs. DDF Truck + 400 l CNG cylinder vs. DDF Truck + 400 liters LNG cylinder vs. DDF Truck + 400 liters LPG Tank



Diesel 100% — 1200 km — 400 l

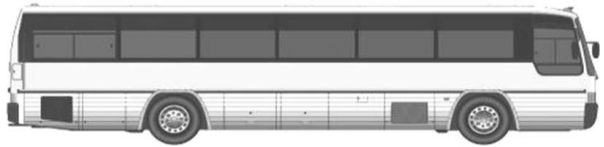
Dual Fuel Diesel + LPG — 1350 km — 1050 Km Dual Fuel LPG + 300 Km Diesel — Diesel tank 400 l + LPG tank 150 l

Dual Fuel Diesel + CNG — 1450 km — 500 Km Dual Fuel CNG + 950 Km Diesel — Diesel tank 400 l + CNG tank 400 l

Dual Fuel Diesel + LNG — 1950 km — 1450 Km Dual Fuel LNG + 500 Km Diesel — Diesel tank 400 l + LNG tank 400 l

Urban Bus CO_2 emission

Average **300** ***CO2*** kg per day
It means ***100*** *Tons*



Before conversion

Diesel Dual Fuel
Compresses Natural Gas

After Conversion

Urban Bus retrofit with
d-gid Diesel Dual Fuel CNG

It reduces **CO2** emission AVG **20%**
so approximately 20 Tons per year same **as growing a wood of 50 trees for each bus converted**(*)

(*) Using **Biomethane** the CO2 reduction is over 50 Tons/year

d-gid® Homologations

d-gid® Components NGV Homologations

All the Natural Gas components we use in our kit are certified according with UNECE 110R and UNECE 10R

UNECE 110R

Specific components for vehicles of category M and N using compressed natural gas (CNG) and/or liquefied natural gas (LNG) in their propulsion system;

UNECE 10R

Vehicles of categories L, M, N and O with regard to electromagnetic compatibility.

d-gid® NGV Homologations

The Italian Ministry of Transport (MIT) homologates our Dual Fuel vehicles according with Italian regulation:

U. di G. – MOT3 n. 220/M3/C2 del 14/02/2000

*The results of the homologation with "U. di G. – MOT3 n. 220/M3/C2 del 14/02/2000" is the **DGM** type approval.*

*ECOMOTIVE SOLUTIONS has got since 2012 the **DGM 59649** who authorized us to homologate Natural Gas Dual Fuel vehicles, through any local department of MIT.*

Ministero
delle Infrastrutture e dei Trasporti
DIPARTIMENTO PER I TRASPORTI , LA NAVIGAZIONE, GLI AFFARI GENERALI ED IL PERSONALE
Direzione Generale per la Motorizzazione
DIVISIONE 3

Prot. ingresso:22410-DIV3-P-910
Prot. uscita 27622

Roma, 30.11.2015

Allegati vari

Alla **ECOMOTIVE SOLUTIONS S.r.l.**
Zona Ind.le Loc. San Iorio, 8 C
15020 Serralunga di Crea (AL)

Oggetto: Ditta **ECOMOTIVE SOLUTIONS S.r.l.**- Serralunga di Crea (AL).

Omologazione complessivo di trasformazione a Metano per veicoli dotati di motori con ciclo diesel. Trasformazione dell'alimentazione originaria da gasolio a gasolio-metano (dual fuel) ai sensi della circolare U.di G. –MOT3 n. 220/M3/C2 del 14.02.2000.

Per il complessivo in oggetto si è dato corso al seguente provvedimento di omologazione:

TIPO	PROVVEDIMENTO	DATA
ECOMOTIVE SOLUTIONS D-GID	DGM 59649 GM Agg.04	23.11.2015

Il DIRETTORE DELLA DIVISIONE
(dr. ing. Vito DI SANTO)

VC

LETTERA+CERTIFICATO-ECOMOTIVE SOLUTIONS D-GID-AGG04

January 2017 Italian Ministry of Transport Approved LNG & BioLNG for Diesel Dual Fuel Retrofit

Italian Ministry of Transport relesed an update U. di G. – MOT3 n. 220/M3/C2 regulation who allow the use of LNG and BioLNG dir Diesel Dual Fuel retrofit. This new regulation comes to comply with the lat update of UNECE 110R that introduced the use of LNG as a vehicle fuel.

Piacenza 22-03-2017

d-gid® Bio-Dual Fuel Projects

Bio-Dual Fuel & Biomethane Project

CONSORZIO ITALIANO BIO-GAS

Biomethane & Diesel Dual Fuel for Agricultural Machinery & Professional Transport

June 2016 Fendt Tractor Tier IV - Diesel Dual Fuel Biomethane

Conference GNL Rome 2015 Itlay

The primary Italina LNG Conference

World first LNG
Tractor Presented in Rome

COFERENCE GNL 2015

presented World first Dual Fuel
World first Dual Fuel LNG tractor

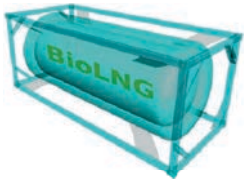
EIMA Bologna 2018 Italy

BRAVO Srl Presented the world first animals food mixer working with CNG thanks to Ecomotive Solutions technology

BIOGAS UPGRADE

clean Biogas, by purging Co2 and non-methanic

LIQUEFACTION



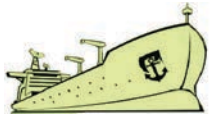
BIOGAS -> BIOMETHANE

BIOMETHANE->Bio LNG

BIOGAS

BIOMASSES->BIOGAS

Final Users



L-LNG & L-CNG STATION

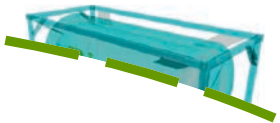
BioLNG->LOGISTIC

Bio LNG LOGISTIC

delivery of BioLNG by cryogenic trylers or ISO containers.

BIOGAS UPGRADE

LIQUEFACTION



BIO

d-gid® Dual Fuel

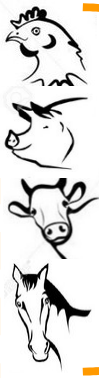
LNG

STIC

ioLNG by

lers or ISO

iners.



June 2016 Fendt Tractor Tier IV - **Diesel Dual Fuel Biomethane**

June 2016 a Biomethane test of a Dual Fuel Biomethane Tractor with Ecomotive Solutions d-gid DDF technology stared at SESA premises in ESTE (PD)

S.E.S.A.

Diesel Dual Fuel LNG NEW Projects Looking for Biomethane

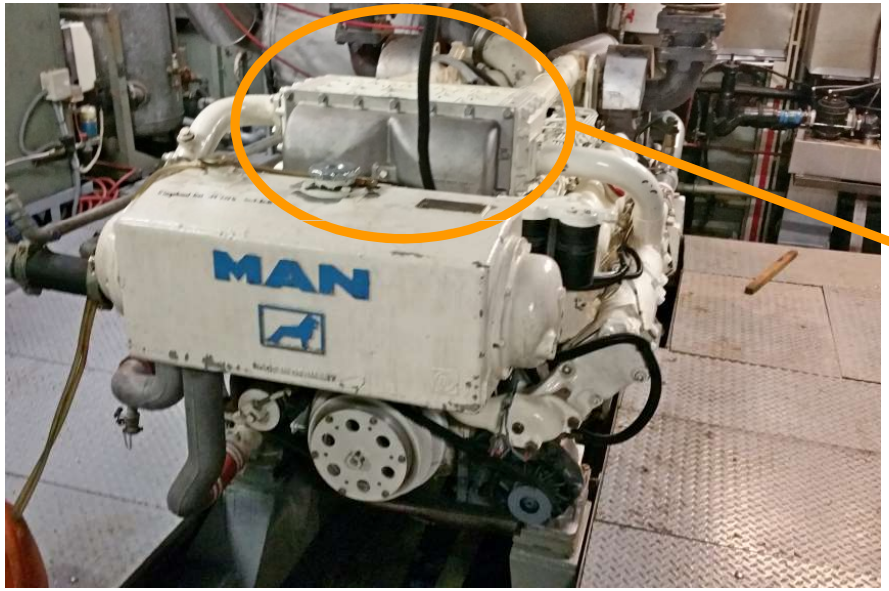
New Ferry Dual Fuel Projects

We are working on new projects for the conversion
of small passenger boats form Diesel to Dual Fuel CNG/LNG

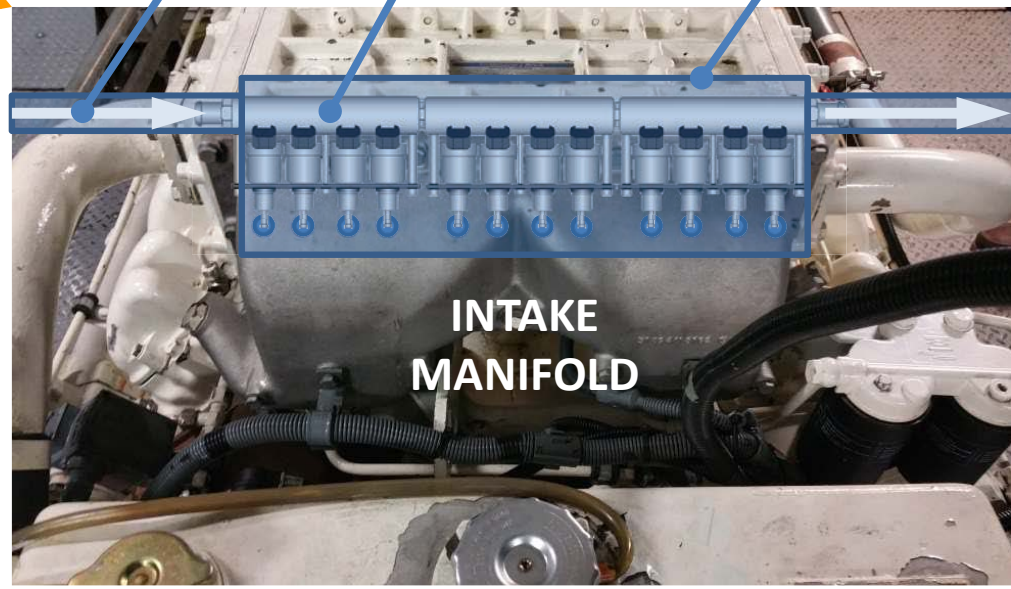
Ferry ITALIA

SOCIETÀ NAVIGAZIONE DEL LAGO DI LUGANO

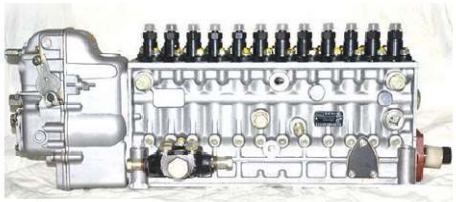
Natural Gas Injectors Layout



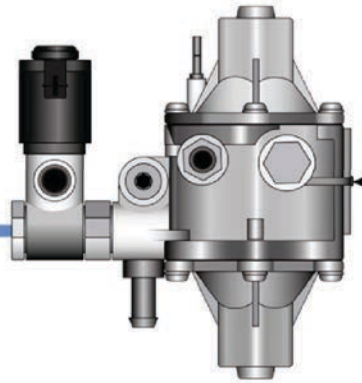
MAN D2842LE



In Line Diesel Pump



Electronic Governor

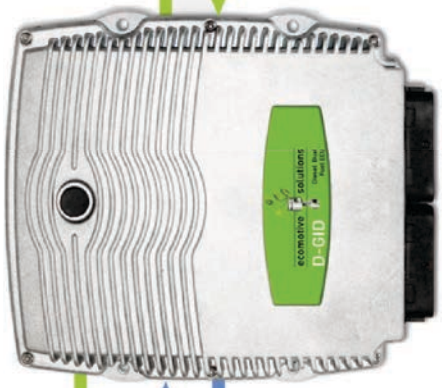


CNG Regualtr

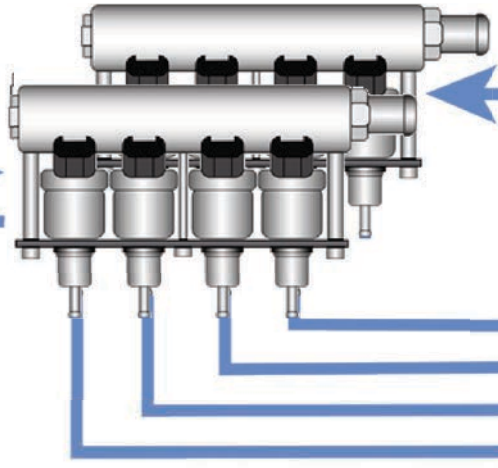
Stoccaggio CNG

In the next future LNG

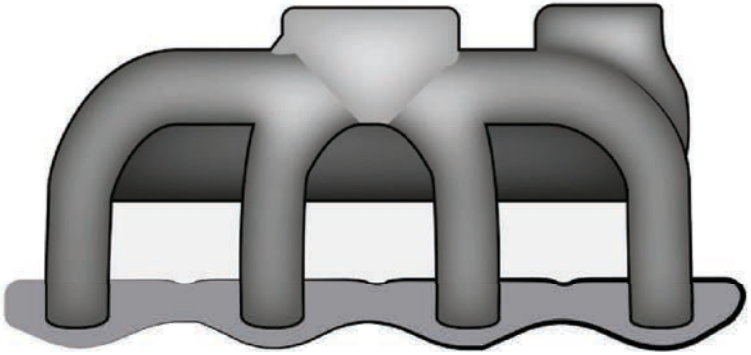
***D**iesel*
***D**ual*
***F**uel*
ECU



Natural Gas Injectors



Intake Manifold



On/Off e Level Switch

Venice experience

Dual Fuel System Application on Express Courier Boats

Engine Double Wall Installation

Dual Fuel LNG for Fishing Boats Project

First Italian Dual Fuel Fishing Boats Project
2012 Porticello Palermo (Sicily) IT

Railways Dual Fuel Projects

We are working on projects on for the conversion of maneuver locomotives for on shore port operations, and on Natural Gas revamping of old Diesel passengers trains in Italy.
Customers: Hitachi, Trenitalia, SNAM

Kalmar Reach Stacker Dual Fuel Projects

GreenCranes

GREENCRANES DEMONSTRATION DAY

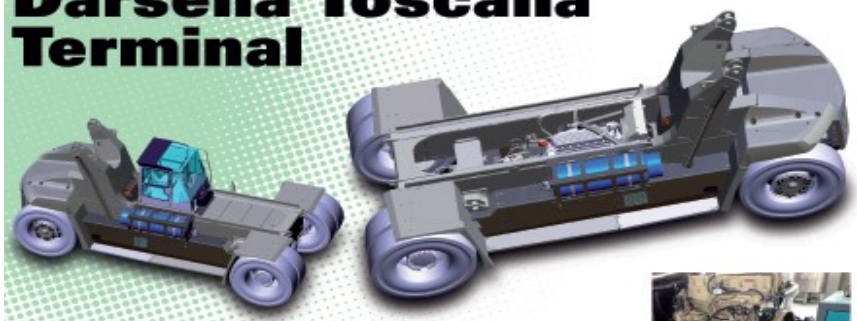
Port of Livorno, January the 16th, 2014

Kalmar Reach Stacker Dual Fuel Projects

GreenCranes

Co-financed by the European Union
Trans-European Transport Network (TEN-T)

Dual-Fuel Reach Stackers at the Livorno Darsena Toscana Terminal



STRUCTURE MODIFICATION

Three are the main changes made to the structure of the reach stacker in order to adapt its diesel engine to be powered with a dual fuel system:

- Installation of a tailor-made cryogenic LNG tank on the right side of the reach stacker. HVM company designed and set up a 220 liters tank with a special tank container to protect it from accidental impacts and to allow rapid installation and removal for maintenance. Tests are being run by Kalmar – Cargotec Group on the capacity and best position for the tank, and the final position and capacity will be defined on the basis of the results of this pilot. All structural changes were made by Global Service based on the design indications of Kalmar's engineering office.
- Set up of the vaporizer and the cryogenic supply line from the LNG tank to the vaporizer that turns LNG in gas.
- Insertion of additional six fuel injectors incorporated into Cummins QSM11 diesel engine model without significant modifications to the cylinder head. The system (designed and implemented by Ecomotive Solutions in cooperation with Global Service) is operated by the electronic control unit for the control and optimization of the LNG and diesel fuel mix, according to the required power in the operating cycle of the machine.

TANK

Cryogenic tank designed and manufactured by HVM.

Global Service has cooperated with HVM srl, a leading company in the production and maintenance of cryogenic tanks.

ENGINE

The 6-cylinder 261KW Cummins QSM11 engine has been modified with the installation of additional LNG injectors

With the dual fuel solution, the diesel engine does not need any invasive structural change and keeps the skill unchanged. The gas is introduced into the system by an additional fuel injector that can be incorporated into diesel engines with minimal modifications to the cylinder head. No special pistons or cylinder are needed. The injected gas comes from a dedicated tank properly sized in relation to the endurance requested.

RESULT 1

Several fuel alternatives were evaluated when considering the reach stacker retrofitting. The most important challenge for H2 and CNG solutions is finding enough room on reach stackers to install a fuel tank with equivalent autonomy. In case of CNG, tank volume would be 4 times the diesel one, while in case of H2 it would be 5 to 10 times. A 100% LNG powered reach stacker would have problems on regular fuel supply due to the lack of LNG stations in the area.

RESULT 2

The dual-fuel solution does not present the problems of the previous solutions, in fact:

- It requires a smaller volume for the LNG tank and therefore there is enough room outside the vehicle.
- It avoids the problem of having to stop the vehicle and having it out of service due to lack of LNG fuel available.

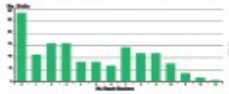
RESULT 3

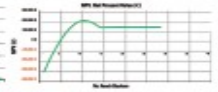
The dual-fuel system keeps unchanged the features of the diesel engine. Its installation is not invasive and the system is reversible. Moreover, the system can be changed to 100% diesel or dual fuel at any time and it does not penalize the original performance of the reach stacker.

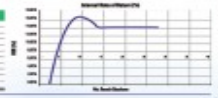
FINANCIAL IMPACT

In GREENCRANES, the methodology for the evaluation and selection of PCTs Eco-Efficient Alternatives has been designed according to technical, environmental and economic criteria. Although the three mentioned requirements need to be satisfied in order to make viable the implementation of a certain alternative, the critical criterion is associated to the cost-benefit result of the investment.

Financial impact significantly depends on the size and use of the reach stacker fleet of the terminal. Key variables affecting profitability of investment are the price gap between the LNG and diesel units, the price of LNG versus industrial diesel and the work load of the container terminal, among others. Modelling and simulation of these and other variables (maintenance, energy consumption, lifespan, machine capacity etc.) are needed to perform an accurate feasibility investment analysis.



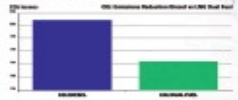




MORE ECO-EFFICIENT

According to the results obtained from the study carried out in the Activity 1 of the project, reach stackers were responsible for 45% of the total CO2 tonnes generated in 2012 (around 1,080 CO2 tonnes) at Livorno Darsena Toscana.

Dual fuel engines decrease pollution significantly (CO, HC, NOx and particulate matter (PM)). Furthermore it reduces the CO2 emissions in the atmosphere thanks to the high percentage of gas in the combined mixture.



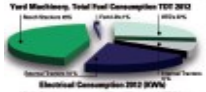
LNG SUPPLY

The challenge concerning LNG supply at the Port of Livorno

Livorno Port Authority is leading a study for analysing the potentialities of a medium/small scale LNG distribution network within the port of Livorno, thinking that the short-term availability of a technical and financial feasibility study for the structuring of a LNG refueling facility, could be a key element for providing the port with the necessary initial background for adopting timely decisions aimed at reaching a competitive advantage, showing the way for setting up a LNG bunkering facility and distribution network.

Taking into consideration different alternatives (e.g. floating station vs. ship-to-share multifunctional facility serving both ships and trucks) and the areas potentially available in the port of Livorno, this study will also outline technical feasibility and economic sustainability aspects, through assessing technical, logistical, financial and regulatory requirements in a reasonably short time, in order to obtain useful elements for supporting decisions that must occur in time with respect to the evolving scenario.

The results of the study will be presented during the Demonstration Day that will take place in December, the 4th, in the Port of Livorno, with the aim of starting a public discussion over the issue "LNG supply in Livorno", that could lead to starting the procedures needed for setting up a refueling facility.



August 2012 – January 2013: Energy Diagnosis

The analysis conducted on the first phase of the project was focused on the main energy sources used at the container terminal: electricity and fuel involved in processes and services. The scope of the study was defined taking into account the key activities of the port container terminal and its operational model.

The analysis of energy consumption (both electrical and fuel) was disaggregated into different types of energy consumer centres involving port machinery, offices and other auxiliary services, following a common methodology with the three container terminals participating in GREENCRANES.

February – April 2013: Feasibility Evaluation

Global Service in collaboration with TDT, APL and Scuola Superiore S.Anna carries out an evaluation of the cost and benefits of the adaptation of a reach stackers fleet to be powered with dual fuel LNG/Diesel. A simulation is conducted for the adaptation of the whole fleet, or restricting it to a selected group of vehicles. The simulation is based on the same approach of the cost-benefit model developed for the LNG terminal tractor in the port of Valencia, and adapted for reach stackers in the port of Livorno. The simulation evaluates the profitability of the investment by means of the calculation of three variables: Net present value (NPV), Internal Rate of Return (IRR) and Investment Payback.

May – October 2013: Prototype Design

Global Service with the cooperation of Ecomotive Solutions (Holdrin Group) designs the modifications of a Cummins QSM11 reach stacker engine to integrate the D-GID dual fuel system provided by Ecomotive Solutions.

Global Service with Ecomotive Solutions implements the necessary modifications for the diesel engine to be powered with dual fuel LNG/Diesel. The two companies are also conducting and finalizing the bench tests of the dual fuel engine.

HVM Company designs and produces the LNG tank for Kalmar reach stacker. Global Service and Kalmar companies implement the necessary structural modification for the installation of the LNG tank and the cryogenic line. Global Service installs the dual fuel engine, LNG tank and cryogenic line and performs workshop tests.

October – December 2013: Pilot and Demostration

The prototype is piloted at the container terminal. Ecomotive Solutions focuses on the analysis of power data while Scuola Superiore S.Anna and Global Service analyze the results and issue conclusions.

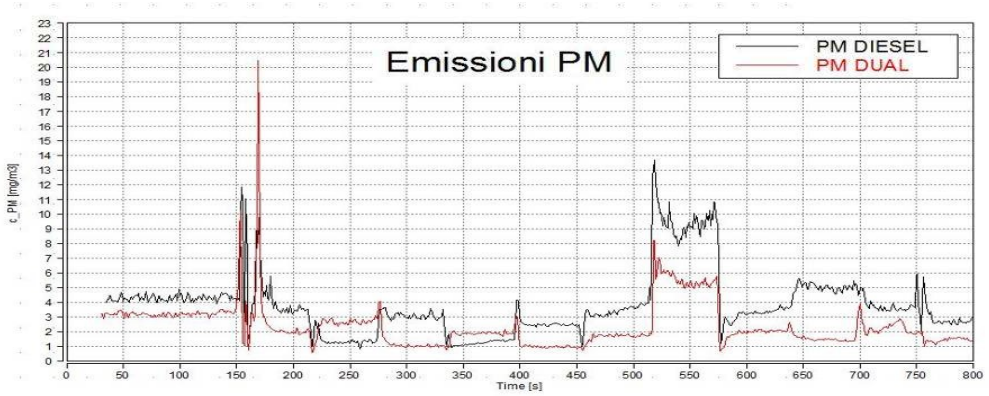
GREEN TECHNOLOGIES AND ECO-EFFICIENT ALTERNATIVES FOR CRANES AND OPERATIONS AT PORT CONTAINER TERMINALS

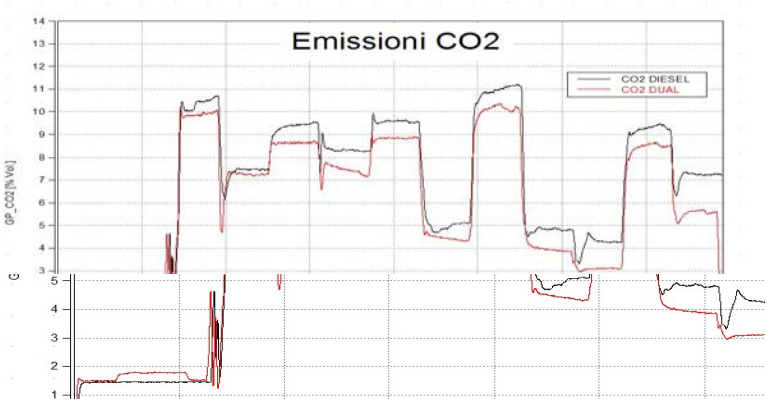
Duisburg Germany

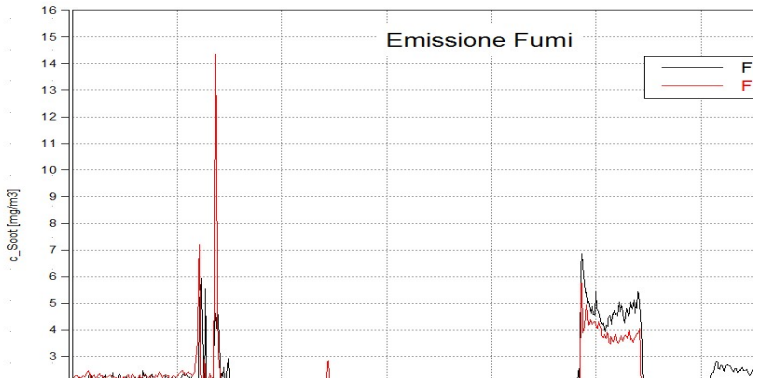
Kalmar Reach Stacker DUAL FUEL LNG Working Session

Emissions Benefits

Typical emissions of an Reach Stacker converted to Dual Fuel Natural Gas







5
Kalmar
MADE IN FINLAND

Kalmar RTG Dual Fuel Projects

LNG Fuel Tank Installation

SEATERMINALS

Kalmar RTG Dual Fuel Projects
2018-2019 India RTG CNG/LNG Installation

Kalmar RTG Dual Fuel Projects
2018-2019 India RTG CNG/LNG roll-out

2020 South Africa Water Tank CAT 777 LNG

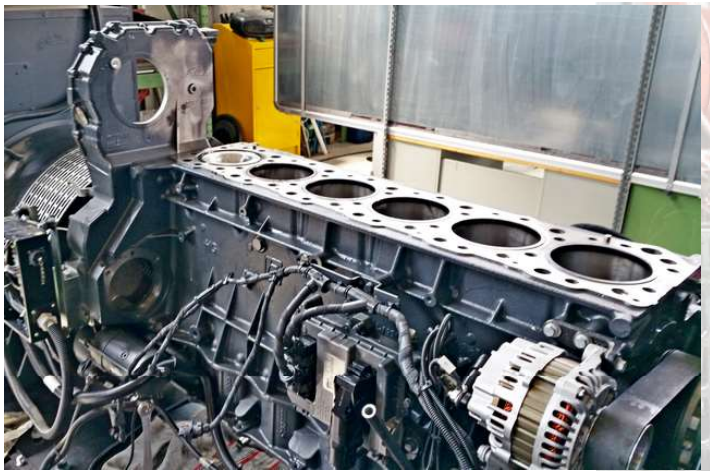
Conversion of a Cat® C32 ACERT 12cyl. - 32.1L -1025hp engine from Diesel to Dual Fuel LNG

#greendustrial

Alternative Fuels Solutions
for Industrial Engines Solutions

#greendustrial is:

Spark Ignited Otto Cycle Engines Conversion, Industrial, Marine & Power Generation



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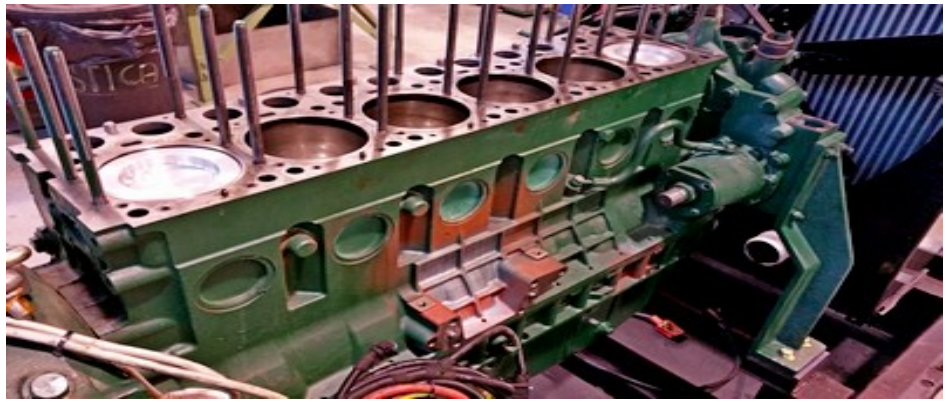
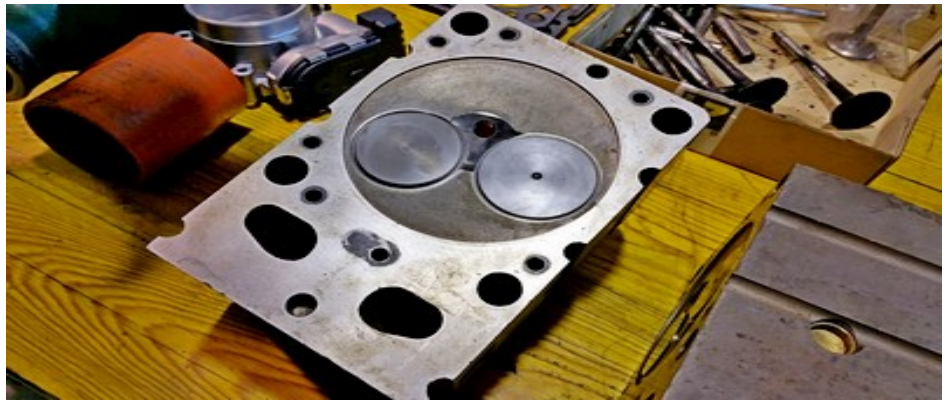
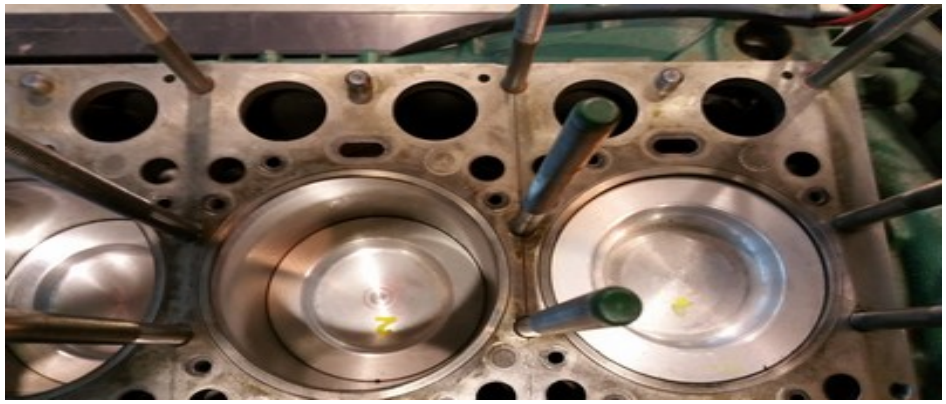
Spark Ignited Otto Cycle Engines Conversion, Industrial, Marine & Power Generation



Conversion of Diesel engines to
100% Natural Gas spark ignited Otto cycle
with phased ignition
Natural Gas / LPG / Syngas
Biogas / Methanol / Ethanol





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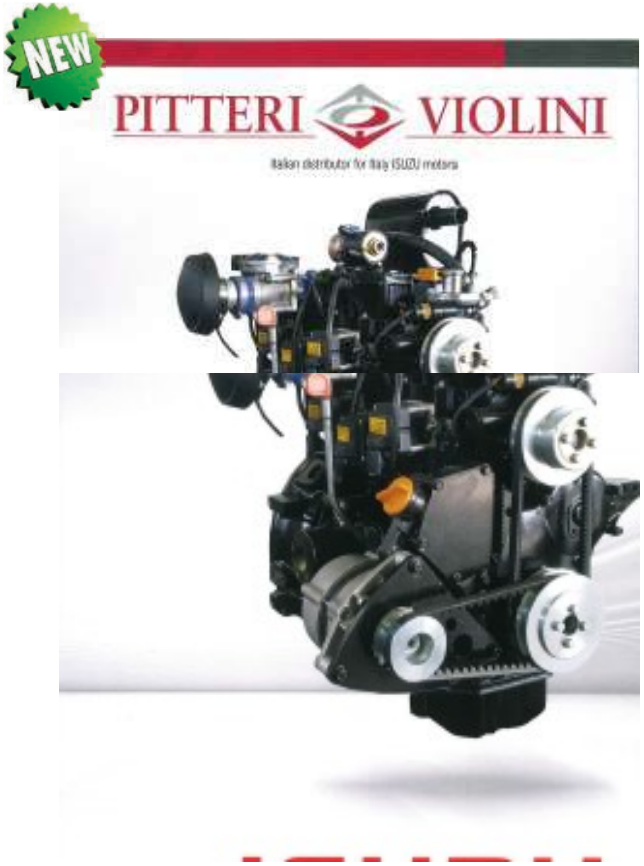
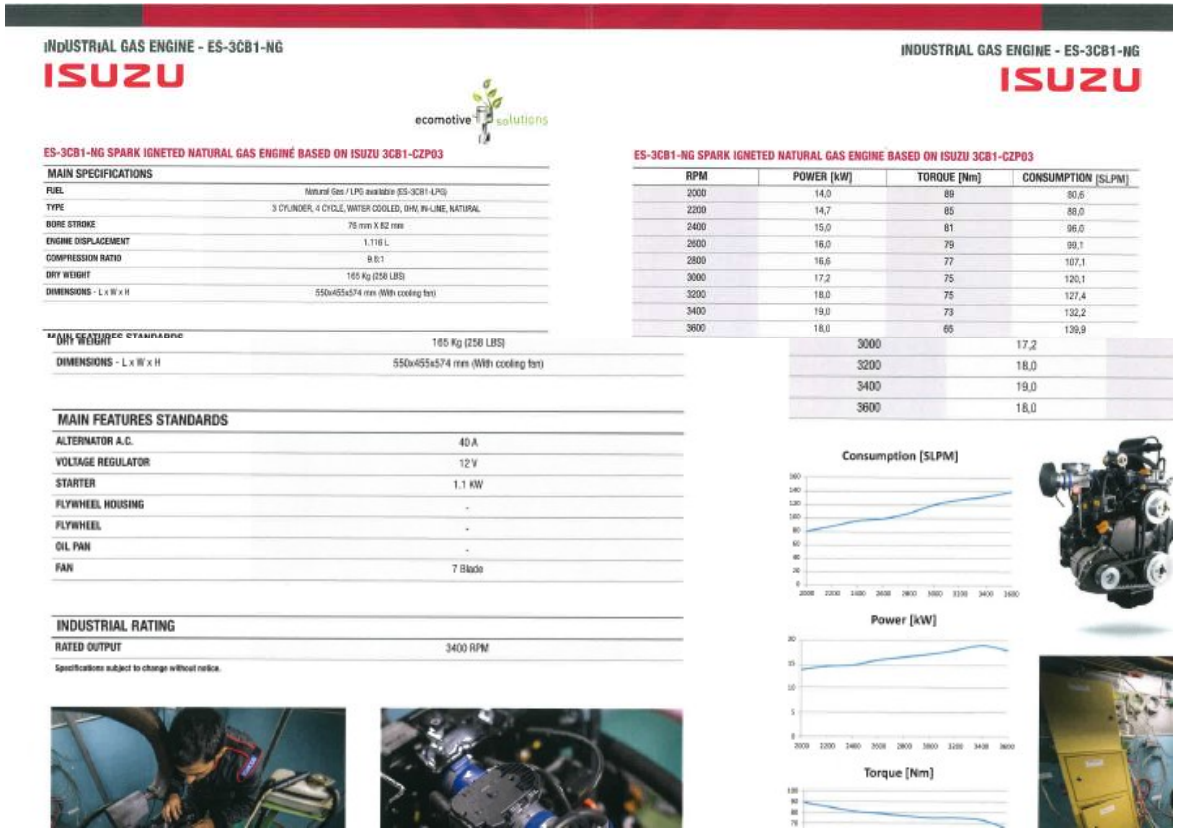



INDUSTRIAL GAS ENGINE - ES-3CB1-NG
ISUZU
ecomotive solutions
ES-3CB1-NG SPARK IGNETED NATURAL GAS ENGINE BASED ON ISUZU 3CB1-CZP03
MAIN SPECIFICATIONS
FUEL
TYPE
BORE STROKE
ENGINE DISPLACEMENT
COMPRESSION RATIO
DRY WEIGHT
DIMENSIONS - L x W x H
165 Kg (258 LBS)
550x455x574 mm (With cooling fan)
MAIN FEATURES STANDARDS
ALTERNATOR A.C. 40 A
VOLTAGE REGULATOR 12 V
STARTER 1.1 KW
FLYWHEEL HOUSING
FLYWHEEL
OIL PAN
FAN 7 Blade
INDUSTRIAL RATING
RATED OUTPUT 3400 RPM
Specifications subject to change without notice.
INDUSTRIAL GAS ENGINE - ES-3CB1-NG
ISUZU
ES-3CB1-NG SPARK IGNETED NATURAL GAS ENGINE BASED ON ISUZU 3CB1-CZP03
RPM | POWER [kW] | TORQUE [Nm] | CONSUMPTION [SLPM]
2000 | 14,0 | 89 | 80,6
2200 | 14,7 | 85 | 88,0
2400 | 15,0 | 81 | 96,0
2600 | 16,0 | 79 | 99,1
2800 | 16,6 | 77 | 107,1
3000 | 17,2 | 75 | 120,1
3200 | 18,0 | 75 | 127,4
3400 | 19,0 | 73 | 132,2
3600 | 18,0 | 66 | 139,9
3000 17,2
3200 18,0
3400 19,0
3600 18,0
Consumption [SLPM]
Power [kW]
Torque [Nm]

Presented at EIMA 2016 international Show in Boulogne IT

#greendustrial is:

Spark Ignited Otto Cycle Engines
Conversion, Industrial, Marine & Power Generation

SCANIA V8 16L SI Engine
480Kw Natural Gas - 280Kw Syngas
Calibration Session

#greendustrial is:

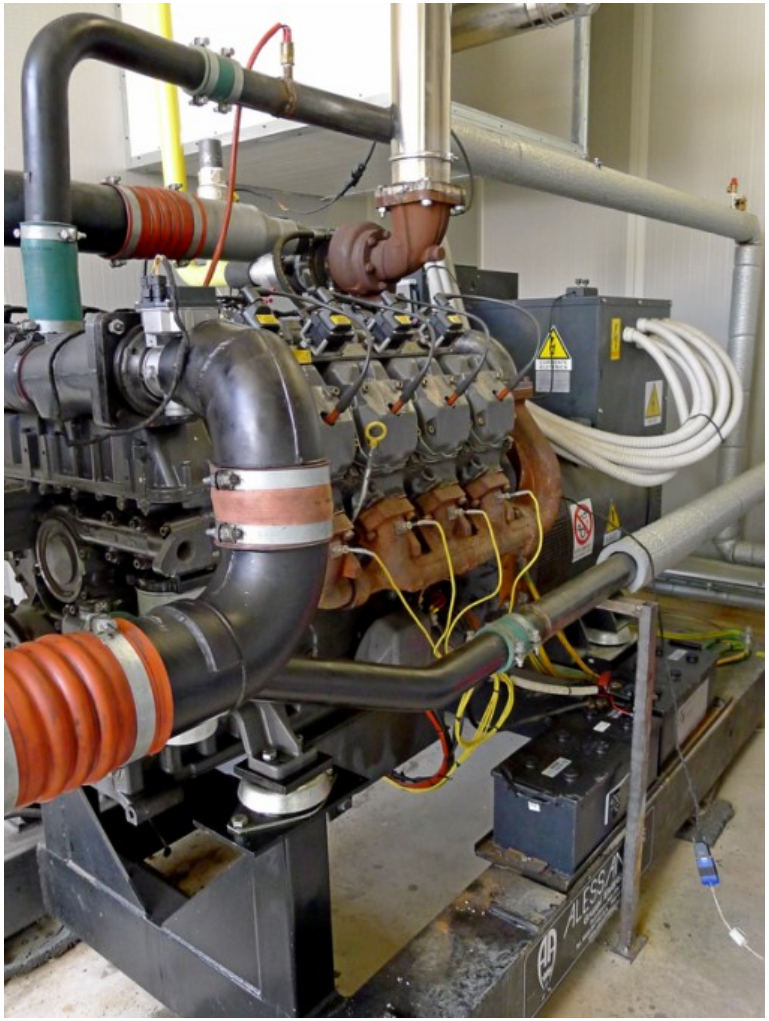
Spark Ignited Otto Cycle

Power Generation

Deutz V8 SI 15L Engine

450Kw Natural Gas - 260Kw Syngas

Installation Session



#greendustrial is:

Diesel Dual Fuel Power Generation - Application on CUMMINS Engine

d-gid® *Genset*
conversion of Power Generators with our d-gid Dual Fuel Technology

d-gid® Dual Fuel Natural Gas Mixer

d-gid® Dual Fuel Controller

Cylinders Temperature Active Control

CAN bus active interface

#greendustrial is:

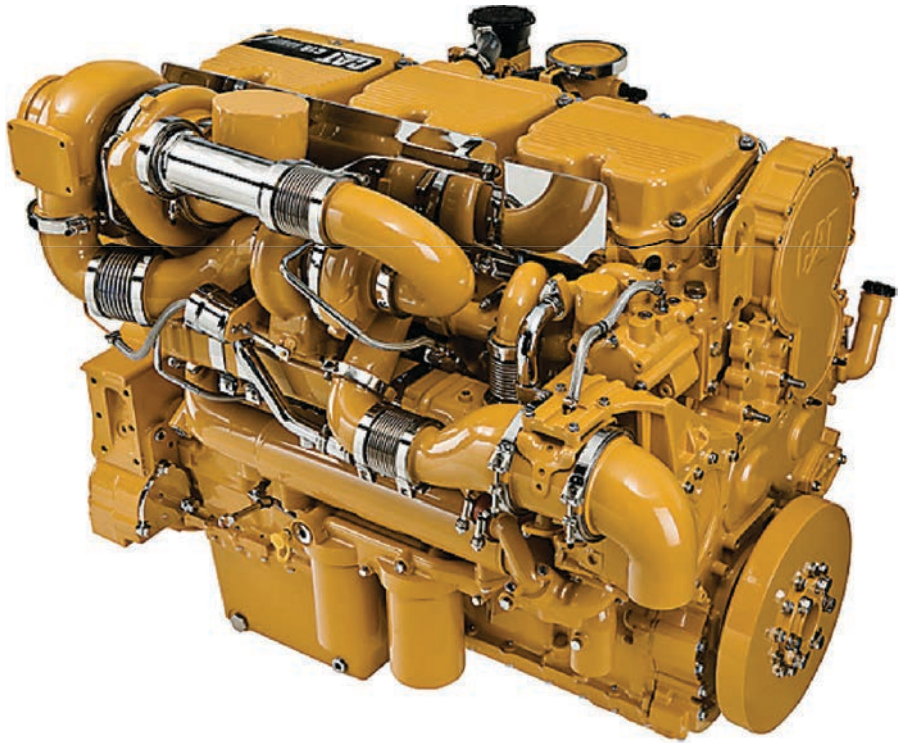
Diesel Dual Fuel Power Generation - Application on CUMMINS Engine

d-gid® *Genset*
conversion of
Power Generators
with our d-gid
Dual Fuel
Technology

Natural Gas gas-train installation
and complete system configuration

#greendustrial is:

Dual Fuel LNG application on Caterpillar C15



Engine Model:	C15
Engine Type:	6 Cylinders, in Line
Displacement:	13 L
Rated Speed:	1500 rpm
Rated Power:	470 kW
Aspiration Method:	T-charged & Intercooled

#greendustrial is:

Dual Fuel LNG application on Caterpillar C15

(d-gid Control System)

#greendustrial is:

Dual Fuel LNG application on Caterpillar C15

(d-gid Calibration)

Some of Our Case Histories

d-gid® Diesel Dual Fuel LNG & BioLNG Retrofit

Case Histories

Our Experience Works

Piacenza ITALY LNG station

Dual Fuel ECOMOTIVE SOLUTIONS truck is refueling

Case Histories

Our Experience Works

Iveco Stralis d-gid® DUAL FUEL LNG conversion

LNG Retrofit realized on Iveco Stralis tricks of FERCAM, a primary Italian logistic & transportation company

Case Histories

Our Experience Works

KAMAZ - Russia - OME d-gid® DUAL FUEL CNG application

Direct installation of the Dual Fuel System at the end of the production line

OEM experience: Our Dual Fuel technology was approved by Kamaz and installed directly ant the end of the production line in Kamaz facility.

2017 Installed 400 units

2018 Installed 800 units

2019 Installed 500 units

Case Histories

Our Experience Works

South Africa - Bus converted with d-gid® DUAL FUEL CNG technology

Johannesburg Converts 30 Buses to Natu

September 4, 2015 | South Africa, Johannesburg and Italy, Serralunga di Crea

Italy's Ecomotive Solutions, a Holdim Group company a
calibration specialist, has supported the conversion of 3
Johannesburg (South Africa) Metrobus fleet into Dual Fu
natural gas) through its South African partner, Vehicle G
recent conversion to natural gas is a part of a "Going Gr

Case Histories

Our Experience Works

Santo Domingo CocaCola fleet converted with d-gid® DUAL FUEL CNG

Case Histories

Our Experience Works

Russia - Dual Fuel installations for Iveco trucks Importer

6-9 OCTOBER 2015 GF THE 5th ST. PETERSBURG INTERNATIONAL GAS FORUM

Case Histories

Our Experience Works

Russia Dual Fuel OEM installation on Ural vehicles

6-9 OCTOBER 2015
THE 5th ST. PETE
INTERNATIONAL
GAS FORUM

Case Histories

Our Experience Works

Mexico - Kneworth trucks fleets conversted with d-gid® DUAL FUEL CNG

Fleet of 30 Mercedes Toreto converted to Dual Fuel
in collaboration with Mercedes officaila Importer Zapata& Nosvam

Slovenia
Flotta Mercedes Actros EURO 6 Dual Fuel LNG per azienda
Semenic Transport

Case Histories

Our Experience Works

Santo Domingo DDF Fleet

Case Histories

Our Experience Works

Chile private and public transportation DDF

Case Histories

Our Experience Works

Brazil Su

Brazil DDF Long Distance Bus

Case Histories

Our Experience Works

ΤΕΧΝΟΛΟΓΙΑ *DUAL FUEL: DIESEL + CNG*

ΜΕΤΑΤΡΟΠΗ ΤΡΑΚΤΟΡΑ ΣΕ ΟΧΗΜΑ ΔΙΠΛΟΥ ΚΑΥΣΙΜΟΥ

ΠΕΤΡΕΛΑΙΟ & ΦΥΣΙΚΟ ΑΕΡΙΟ

Τη μετατροπή πραγματοποίησε επιτυχώς η βορειοελλαδίτικη εταιρεία NGT – Natural Gas Technologies, την οποία γνωρίσαμε στην περυσινή έκθεση του T&T «Transport Show». Να υπενθυμίσουμε στους αναγνώστες μας ότι έχει ήδη επιτραπεί η μετατροπή οχημάτων σε διπλού καυσίμου βενζίνης – φυσικού αερίου. Λέγοντας διπλού καυσίμου σημαίνει ότι κινούνται ταυτόχρονα και με τα δύο καύσιμα σε συγκεκριμένη αναλογία το καθένα ενώ είναι δυνατή και η κίνηση του οχήματος με το ένα μόνο καύσιμο. Ακόμη υπενθυμίζουμε ότι το CNG είναι ο υδρογονάνθρακας μεθάνιο και επειδή (το μεθάνιο), δεν αποτελεί προϊόν διύλισης, λέγεται φυσικό αέριο, όταν δε, αποθηκεύεται υπό πίεση παίρνει τη γνωστή σε μας ονομασία CNG.

Κατανάλωση

Για το αποτελέσματα στην κατανάλωση, το κόστος της μετατροπής και τα βασικά στοιχεία που πρέπει να γνωρίζει ο ενδιαφερόμενος, μιλάει στο T&T ο τεχνικός υπεύθυνος της NGT κ. Γιώργος Αμπαταϊδης και απαντά στις ερωτήσεις μας.

Όπως αναφέρθηκε, η μετατροπή σε όχημα διπλού καυσίμου (dual fuel) και πρώτη σε βαρύ όχημα, έγινε σε τράκτορα μάρκας DAF XF 105 460 ιδιοκτησίας του ομίλου FHL KIRIAKIDIS A.E. ενώ

Τα τεχνικά στοιχεία της μετατροπής και το κιτ «d-gid»

Τα μηχανολογικά εξαρτήματα μιας μετατροπής πετρελαιοκινητήρα σε dual-fuel, είναι κοινά με της bi-fuel (Βενζίνη-CNG), δηλαδή φιάλη - αυτόματη βαλβίδα - ατσάλινη σωλήνα υψηλής πίεσης - ανεύρυσμα - σωλήνα χαμηλής - μπεκ. Τα εξαρτήματα μετά τον ανευρυσμα δε, είναι κοινά και με τα γνώριμα του LPG.

Αυτό που αλλάζει τελείως είναι το ηλεκτρικό/ηλεκτρονικό μέρος. Ο εγκέφαλος (ECU) d-gid επικοινωνεί με το ποτενσιόμετρο του πεντάλ του γκαζιού αλλά και με την CAN BUS του οχήματος, ούτως ώστε να μπορέσει να μειώσει την έγχυση του πετρελαίου και να την αντικαταστήσει στοιχειομετρικά με την αντίστοιχη ποσότητα αερίου, δυναμικά και μεταβαλλόμενα σε όλο το φάσμα

ΥΜΕ όλα τα εξαρτήματα του κιτ d-gid, καθώς και τη συμμόρφωση μέχρι και για EURO 5, όπως αυτή εκδόθηκε βάσει αποτελεσμάτων δοκιμών από τα ιταλικό ΥΜΕ.

Ασφάλεια-κόστος-φθορές

Για την ασφάλεια της εγκατάστασης, το κόστος και τυχόν φθορές, ο κ. Αμπαταϊδης μας αναφέρει:

«Η ασφάλεια της εγκατάστασης είναι δεδομένη λόγω της απόλυτης συμμόρφωσης των εξαρτημάτων και των κανόνων της διοικευής βάσει του R110. Οι συνεργαζόμενοι εγκαταστάτες μας δε, έχουν εκπαιδευθεί στην Ιταλία πάνω στο συγκεκριμένο αντικείμενο.

Το κόστος της εγκατάστασης σε ένα ελαφρύ επαγγελματικό όχημα κυμαίνεται από 3.000 έως 4.000 € + ΦΠΑ. Για ένα βαρύ όχημα από 10.000 έως 12.000. Σε κάθε περίπτωση η διακύμανση οφείλεται στην επιλογή περισσότερων ή λιγότερων φιαλών

We got the absolute first HDV homologation in Greece released by the Greek Ministry of Transport.

Το πώς επιτυγχάνεται η παραπάνω οικονομία, αποτυπώνεται στον παρακάτω πίνακα, όπου λαμβάνεται ως δεδομένο σύγκρισης, ότι για έναν αντίστοιχα μικτό κύκλο διαδρομών, το συγκεκριμένο DAF θα είχε κατανάλωση σε πετρέλαιο 40 λίτρα για τα 100 χιλιόμετρα.

DAF XF 105 460					
Euro 5, μον. 2012, 460 hp					
Diesel tank:	400lt (αφαιρέθηκε η 2η δεξαμενή των 1200 lt)				
CNG tank:	8x70lt (μέγιστη πλήρωση ~70kg)				
Αυτονομία:	(σε dual-fuel mode) ~600km				
Πριν		Μετά			
Diesel		Diesel		CNG	
Lt/100km	€/Lt	Lt/100km	€/Lt	Kg/100km	€/kg
40	1.07	22	1.07	12	0.75
-		23.54 €		9 €	
42.8 €		32.54 €			
		-23,97%			

Σημαντικό επίσης στοιχείο που πρέπει να προσέξετε στον παραπάνω πίνακα είναι η αναλογία μίξης των δύο καυσίμων που είναι 30 προς 70 (πετρέλαιο προς φυσικό αέριο) και το γεγονός ότι το μεν πετρέλαιο πωλείται όπως γνωρίζουμε σε λίτρα, ενώ το φυσικό αέριο πωλείται σε κιλά.

Case Histories

Our Experience Works

BM Carrozzerie Brescia

Per Gruppo Arriva Autobus Interurbani Dual Fuel

Case Histories

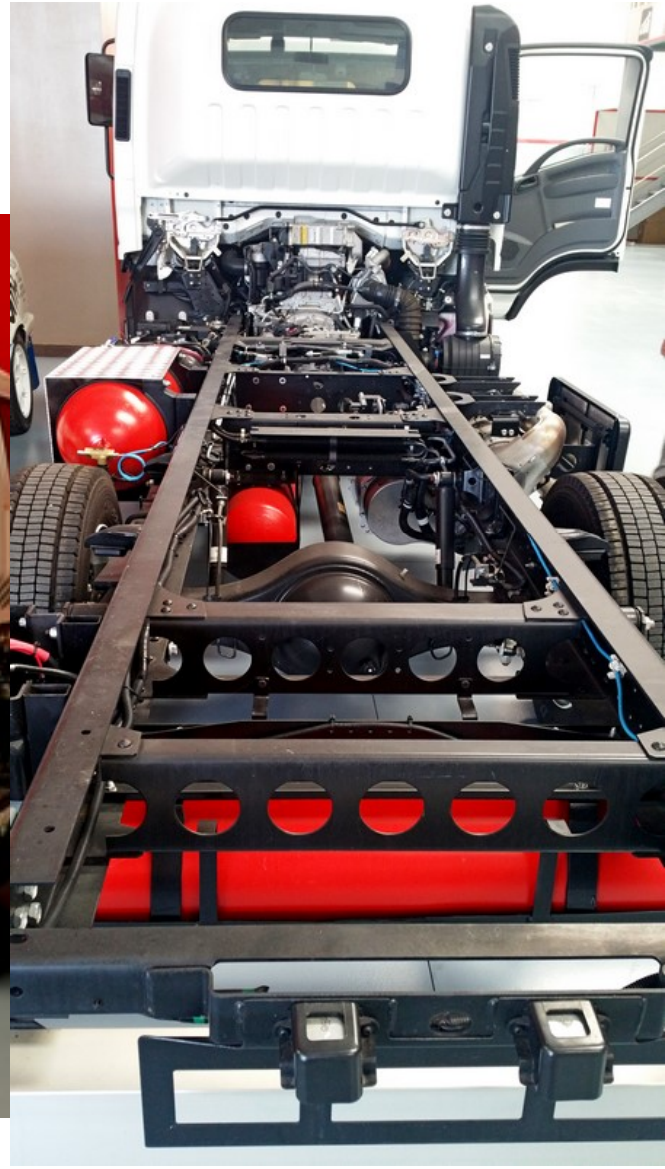
Our Experience Works

Italy - Dual Fuel Sub Urban Buses for Genoa public transportation company

Case Histories

Our Experience Works

Isuzu EURO VI Dual Fuel CNG System Layout



Case Histories

Our Experience Works

Italy - Dual Fuel Vehicles converted for Municiopality Operators

Case Histories

Our Experience Works

OEM Dual Fuel designed for Bucher Municipal

ISUZU Dual Fuel coverted for SEA

Case Histories

Our Experience Works

SNAM & SAN 4 Mobility

Dual Fuel fleet of service vehicles, for Italian pipeline owner

Case Histories

Our Experience Works

Piccini Impianti

Italy - Dual Fuel vans rental service

Case Histories

Our Experience Works

Arzelli Genoa - Itlay

Dual Fuel VW Crafter fleet for magazines and newspaper daily delivery

Case Histories

Our Experience Works

Zago Automotive
Spain

100 Dual Fuel VW Crafter for:

- **Miele service Spain**
- **Correos express courrier Spain**

Case Histories

Our Experience Works

Arzelli Genoa - Italy

A fleet of 15
Dual Fuel Nissan NV300
for school service

Case Histories

Our Experience Works

Officina Dell'Orto for Poste Italiane (mail delivery)

10 Dual Fuel Peugeot Boxer
10 Dual Fuel Peugeot Expert

Case Histories

Our Experience Works

AB Cogeneration - Itlay

Fleet of Dual Fuel vehicles for Technical assiastance

2018
TORINO PECHIN
EURO5 Totyota Hilux convertet to Dual Fuel CNG
An expert driver: Guido Guerrini
Our mascotte: Bruno the wild boar
More then 40.000 km in 4 months
From Italy to Cina and back
With Natural Gas is Possible!
Moscow
Kazan'
Ufa
Tyumen'
Yekaterinburg
Omsk
Novosibirsk
Krasnoyarsk
Khabarovsk
Vladivostok
Beijing
Xi'an
Vilnius
Czestochowa
Torino
Sansepolcro
Dushanbe

2018

TORINO PECHIN

PREQUEL: Bruxelles Europena Parliament Dual Fuel Tour Presentation

START:

TURIN - Italy - San Carlo Square

June 16th 2018

ARRIVAL:

TURIN - Italy - City Hall

October 28th 2018

2018 TORINO PECHINO
Natural Gas Tour

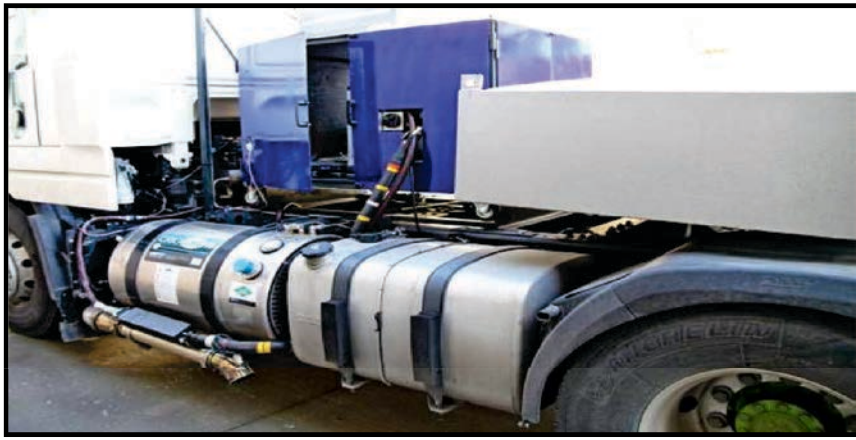
The Adventure will contine...

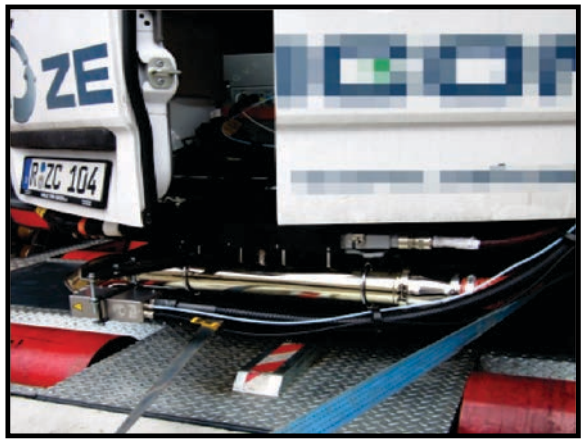
Read Torino-Pechino diary on:

www.torinopechino.com

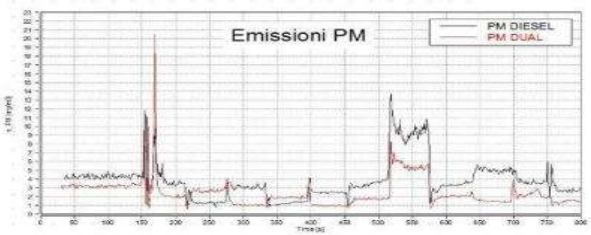
Our Services & Know-How

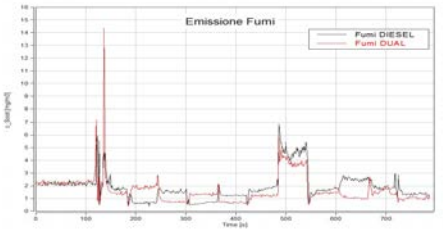
Emission Test in Real-World Driving with PEMS System





Portable Emission Measurement System, lightweight laboratory which purpose is to test and assess emissions on mobile sources during on-the-road tests or in dynamometer sessions. This service can be offered also on site by our specialized technicians.

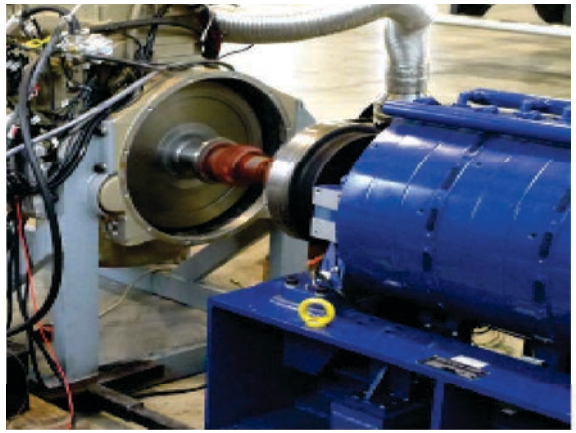


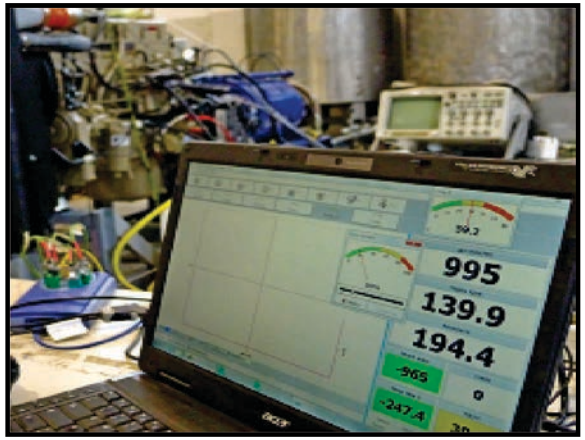


Rolling Road Dynamometers Test and OEM Production

Thanks to the technologies available at the Holdim group, our chassis dynamometers have been provided with a hydraulic link supporting realistic road simulations in all the engine working conditions while testing cars/light vehicles, heavy duty trucks and buses, tractors and motorbikes.
Not only we support tests specifically conceived for a wide range of purposes, but we also develop special tools and solutions based on our clients' needs.

Alternative Fuels Engine Development





Our structure, together with a wide partners network, offers a comprehensive range of services focused on the development of the engine working with alternative fuels. Our power bench testers/chassis dynamometers and the engineering support provided by our companies assure the highest features in testing and for the development of reliable performances.

Special Developments & Partnership for EU Calls

Development of special products and projects according to the EU call requirements in partnership with Universities, Public Entities and OEM or any company which needs to obtain validation and certification concerning the alternative fuels and new technologies application.

THANK YOU

TECHNOLOGIES
TO SUPPORT ECOLOGY